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L1: Entry 3 of 5 File: DWPI Oct 1, 1996

DERWENT-ACC-NO: 1996-495182
DERWENT-WEEK: 199649

103

TITLE: Plasma etching method for suppressing change in etching speed of silicon di:oxide - comprises cleaning and seasoning using mixed gas plasma comprising chlorine gas and silicon tetra:chloride

Nawata et al

PRIORITY-DATA:
1995JP-0058546 March 17, 1995

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 08255786 A	October 1, 1996	N/A	004	H01L021/3065

INT-CL (IPC): C23F 4/00; H01L 21/3065

ABSTRACTED-PUB-NO: JP08255786A
BASIC-ABSTRACT:

After a cleaning process, seasoning is performed using a mixed gas plasma of chlorine gas and silicon tetrachloride. The affect of the residual object in a process room after the cleaning process is decreased.

USE - For suppressing a change in an etching speed of silicon dioxide.

L9 ANSWER 3 OF 5 JAPIO COPYRIGHT 2000 JPO
AN 1996-255786 JAPIO
TI PLASMA **ETCHING** METHOD
IN NAWATA MAKOTO; YAKUSHIJI MAMORU
PA HITACHI LTD, JP (CO 000510)
PI **JP 08255786** A 19961001 Heisei
AI JP1995-58546 (JP07058546 Heisei) 19950317
SO PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 96, No. 10
IC ICM (6) H01L021-3065
ICS (6) C23F004-00
AB PURPOSE: To provide a plasma **etching** method suited to improve the uniformity between **wafers** by suppressing the variation of the **etching** speed of **Si** and an **oxide** film (**SiO2**) of an underlying film after **cleaning**.
CONSTITUTION: After **cleaning**, the **seasoning** is done using a mixed gas plasma of **Cl2** and SiCl4 to reduce the influence of **residues** in a treating chamber after **cleaning**. Thus, the influence of F remaining after **cleaning** can be suppressed and the variation of the **etching** speed of the **Si** and **oxide** film can be avoided.

L8 ANSWER 3 OF 5 CA COPYRIGHT 2000 ACS
AN 126:41256 CA
TI Plasma **etching** of **silicon** or **silicide**
IN Nawata, Makoto; Yakushiji, Mamoru
PA Hitachi Ltd, Japan
SO Jpn. Kokai Tokkyo Koho, 4 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM H01L021-3065
ICS C23F004-00
CC 76-3 (Electric Phenomena)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE	
PI	JP 08255786	A2	19961001	JP 1995-58546	19950317	<--
	JP 3067576	B2	20000717			

AB **Si**, **polycryst. Si**, or **silicide** is plasma **etched** by the following process; (1) **cleaning** by a F-contg. gas plasma, (2) elec. discharging a plasma (**seasoning**) of a gas contg. **Cl2** and SiCl4, and (3) beginning **etching** using an **etchant** gas contg. **Cl2** and optionally O2. The **cleaning** process effectively **removes residues** of the plasma **etching**, and suppresses effects of F originated from the **cleaning** gas, and is suited for manuf. of semiconductor devices.

ST **silicon** plasma **etching** app **cleaning**; **oxide silicon** plasma **etching** app; semiconductor **silicon** plasma **etching**

IT **Cleaning**
(in plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT Sputter **etching**
(plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT Semiconductor devices
(**silicon wafer**; plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT 2551-62-4, Hexafluorosulfur 7782-41-4, Fluorine, uses 7783-54-2, Trifluoroamine 7790-91-2, Trifluorochlorine 13709-36-9, Xenon difluoride
RL: TEM (Technical or engineered material use); USES (Uses)
(**cleaning** gas; in plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT 7782-44-7, Oxygen, uses
RL: NUU (Nonbiological use, unclassified); USES (Uses)
(**etchant** gas component; in plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT 7782-50-5, Chlorine, uses
RL: NUU (Nonbiological use, unclassified); USES (Uses)
(**etchant** gas; in plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT 10026-04-7, **Silicon** tetrachloride
RL: TEM (Technical or engineered material use); USES (Uses)
(plasma discharging gas; in plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

IT 7440-21-3, **Silicon**, processes 7631-86-9, **Silicon** dioxide, processes 14808-60-7, Quartz, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(plasma **etching** of **silicon** or **silicide** followed by **cleaning etching** app.)

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（A）　(11)特許出願公開番号

特開平8－255786

(43)公開日　平成８年(1996)10月１日

(51)Int.Cl.[6]	識別記号	庁内整理番号	Ｆ１		技術表示箇所
Ｈ０１Ｌ　21/3065			Ｈ０１Ｌ　21/302	Ｎ	
Ｃ２３Ｆ　4/00			Ｃ２３Ｆ　4/00	Ｄ	
				Ｅ	
			Ｈ０１Ｌ　21/302	Ｆ	

審査請求　未請求　請求項の数３　ＯＬ　（全 ４ 頁）

(21)出願番号　特願平7－58546

(22)出願日　平成７年(1995)３月17日

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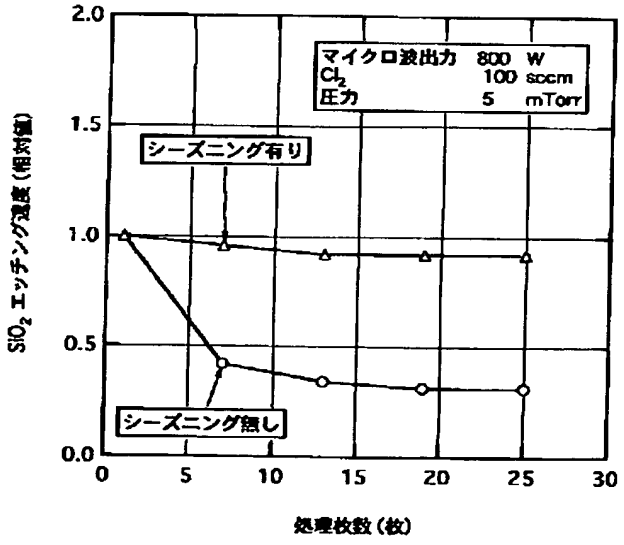
(54)【発明の名称】　プラズマエッチング方法

(57)【要約】
【目的】クリーニング後のシリコン及び下地膜である酸化膜(SiO_2)のエッチング速度の変化を抑制しウエハ間の均一性を向上させるのに好適なプラズマエッチング方法を提供することにある。
【構成】クリーニング後Cl_2と$SiCl_4$の混合ガスプラズマでシーズニングを行い、クリーニング後の処理室内の残留物の影響を減少させる。
【効果】クリーニング後の残留フッ素の影響を抑制しシリコン及び酸化膜のエッチング速度の変動を防止することができる。

図　5



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【特許請求の範囲】

【請求項１】フッ素を含むガスプラズマによりクリーニングを行い、クリーニング後塩素ガス(Cl_2)の単独ガスあるいは塩素ガス(Cl_2)と酸素ガス(O_2)の混合ガスをエッチングガスとして用い、ガス圧力20mTorr以下でシリコン、多結晶シリコン及びシリサイドのエッチングを行うプラズマエッチング装置において、クリーニング後にCl_2ガスと$SiCl_4$ガスの混合ガスのプラズマで馴らし放電（以下シーズニングと称す）を行った後エッチングを開始することを特徴とするプラズマエッチング方法。

【請求項２】請求項１に記載のフッ素を含むガスが、六フッ化硫黄(SF_6)、三フッ化窒素(NF_3)、二フッ化キセノン(XeF_2)、フッ素(F_2)、三フッ化塩素(ClF_3)の単独ガスあるいは混合ガスであることを特徴とするプラズマエッチング方法。

【請求項３】請求項１に記載の該クリーニング及び該シーズニングにおいて、シリコン上に酸化膜(SiO_2)を形成した基板もしくは石英基板を用いて、該クリーニング及び該シーズニングを連続して行うことを特徴とするプラズマエッチング方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、フッ素を含むガスプラズマによりクリーニングを行い、クリーニング後、塩素ガス(Cl_2)の単独ガスあるいは塩素ガス(Cl_2)と酸素ガス(O_2)の混合ガスをエッチングガスとして用いてシリコン、多結晶シリコン及びシリサイドのエッチングを行うプラズマエッチング装置において、クリーニング後のシリコン及び下地膜である酸化膜(SiO_2)のエッチング速度の変化を抑制しウエハ間の均一性を向上させるのに好適なプラズマエッチング方法に関するものである。

【０００２】

【従来の技術】従来、エッチングを含めたプラズマプロセスではウエハの粒子汚染を防止するためにクリーニングを行いクリーニング後の処理室の残留物をなくすためにポストクリーニングを行っている。SF_6,NF_3ガスをクリーニングを用いた場合にはN_2,Ar,O_2ガスプラズマがポストクリーニングに用いられている。なお、この種の技術に関するものには、例えば文献：平塚豊著、洗浄設計P41-53,1992.Summerが挙げられる。

【０００３】

【発明が解決しようとする課題】従来のエッチング装置では、クリーニング後の処理室内の残留物のエッチング特性に及ぼす影響について考慮されておらず、クリーニング後処理枚数とともにシリコン及び下地膜の酸化膜のエッチング速度が減少し、下地酸化膜の残膜が変動するという問題点があった。

【０００４】本発明の目的は、クリーニング後のシリコン及び酸化膜のエッチング速度の減少を抑制し、下地酸化膜の残膜の変動を防止し良好なウエハ間の均一性が得

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られるプラズマエッチング方法を提供することにある。

【０００５】

【課題を解決するための手段】上記目的は、クリーニング後Cl_2ガスと$SiCl_4$ガスの混合ガスのプラズマでシーズニングを行い、クリーニングの処理室内の残留物の影響を減少させることにより、達成できる。

【０００６】

【作用】図1は、SF_6ガスプラズマでクリーニングを行った後、Cl_2ガスプラズマでシリコンをエッチングした場合におけるSiFの発光スペクトルの処理枚数による変化を示す。シリコンとフッ素の反応によって生成するSiFの発光スペクトルの強度は処理枚数とともに減少しほぼ一定となる。このことからフッ素を含むガスによるクリーニング後、処理室内にはフッ素が残留していることがわかった。次に図2、及び図3に、Cl_2ガスにSF_6ガスを添加した場合のSiFの発光スペクトルとシリコン及び酸化膜のエッチング速度の変化を示す。図2に示すようにSF_6の添加量の増加とともにSiFの発光スペクトルの強度は増加する。また、図３に示すようにSF_6の添加量の増加とともにシリコン及び酸化膜のエッチング速度は増加する。このことから残留フッ素の減少とともにシリコン及び酸化膜のエッチング速度が低下することを見い出した。したがって、クリーニング後残留フッ素の除去のためCl_2と$SiCl_4$の混合ガスプラズマでシーズニングを行い、SiFの発光スペクトルの強度の時間変化が一定値以下になった時点でシーズニングを終了しエッチングを開始することによりシリコン及び酸化膜のエッチング速度の変動を抑制できる。

【０００７】

【実施例】以下、本発明の一実施例を図４により説明する。図4は、マイクロ波プラズマエッチング装置の概略図を示したものである。図４において、マグネトロン1から発振したマイクロ波は導波管2を伝播しベルジャー3を介して処理室4に導かれる。処理室4はベルジャー3、載置電極5及びアース電極6によって構成されている。磁界発生用直流電源7からソレノイドコイル8に供給される直流電流によって形成される磁界とマイクロ波電界によってエッチングガス供給装置9から供給されるクリーニングガス(SF_6)、シーズニングガス(Cl_2,$SiCl_4$)及びエッチングガス(塩素ガス(Cl_2))はプラズマ化される。SF_6ガスプラズマにより処理室4のクリーニングが行われる。Cl_2と$SiCl_4$の混合ガスプラズマにより処理室4のシーズニングが行われる。クリーニング及びシーズニング時には載置電極5上には石英製の基板が載置されている。クリーニング及びシーズニングの後、Cl_2ガスプラズマによって載置電極5に載置されている基板10がエッチングされる。クリーニング、シーズニング及びエッチング時の圧力は真空排気装置11によって制御される。基板10に入射するイオンのエネルギは載置電極5に高周波電源12から供給される高周波電力によって制御される。図5、及

び図6にシーズニングの有無によるシリコン及び酸化膜のエッチング速度の変化の違いを示す。シーズニングはCl_2と$SiCl_4$の混合ガスプラズマにより行い、SiFの発光スペクトルを10秒毎にモニターし時間tnと時間tn-1に測定したスペクトルの発光強度比が1±0.002になった時点でシーズニングを停止した。クリーニング後にシーズニングを行うことによりクリーニング時に生成されるフッ素の残留の影響を抑制しエッチング速度の変動を防止できる。

【０００８】本実施例によれば、クリーニング後の残留フッ素の影響を抑制しシリコン及び酸化膜のエッチング速度を防止することができる。

【０００９】本実施例では、マイクロ波プラズマエッチング装置についてその効果を説明したが、他の放電方式、例えば誘導結合型放電方式、内部エネルギ供給放電方式においても同様な効果が得られる。

【００１０】

【発明の効果】本発明によれば、クリーニング後の残留フッ素の影響を抑制しシリコン及び酸化膜のエッチング

速度を防止することができる。

【図面の簡単な説明】

【図１】SiF発光強度の処理枚数依存性を示す説明図である。

【図２】SiF発光強度のSF_6添加量依存性を示す説明図である。

【図３】Si及びSiO_2エッチング速度のSF_6添加量依存性を示す説明図である。

【図４】本発明の一実施例を示すマイクロ波プラズマエッチング装置の構成図である。

【図５】本発明の一実施例での効果を説明するためのSiO_2エッチング速度の処理枚数依存性を示す説明図である。

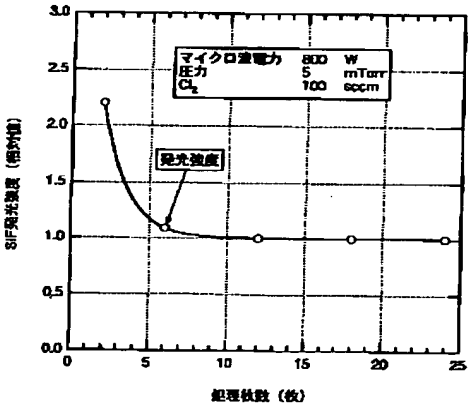
【図６】本発明の一実施例での効果を説明するためのSiエッチング速度の処理枚数依存性を示す説明図である。

【符号の説明】

3…ベルジャー、6…アース電極、7…ソレノイドコイル、9…基板。

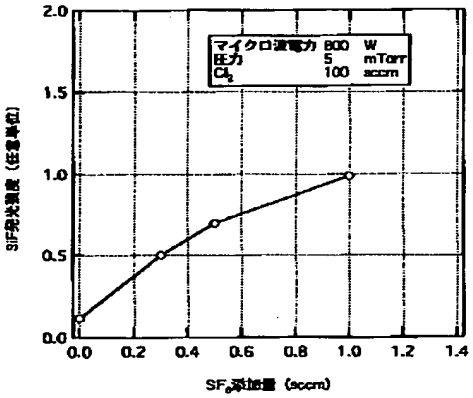
【図１】

図 1



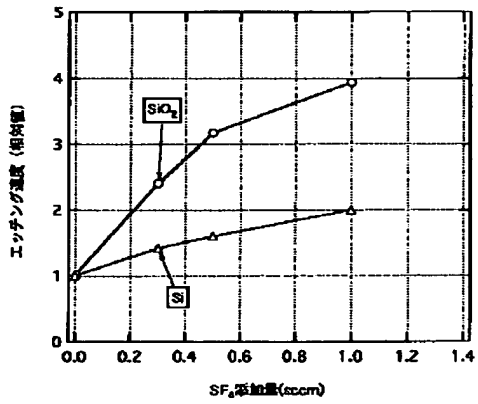
【図２】

図 2



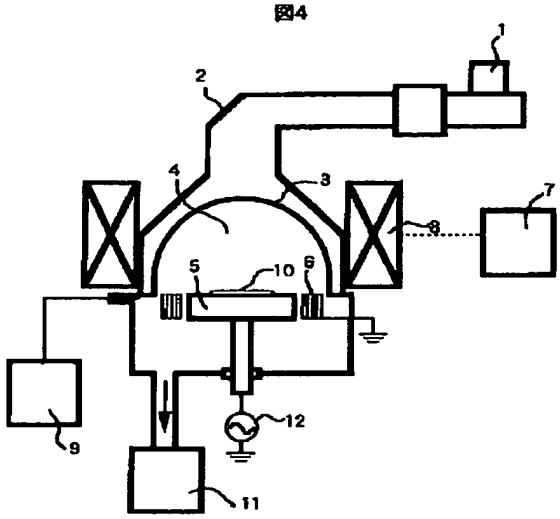
【図3】

図 3



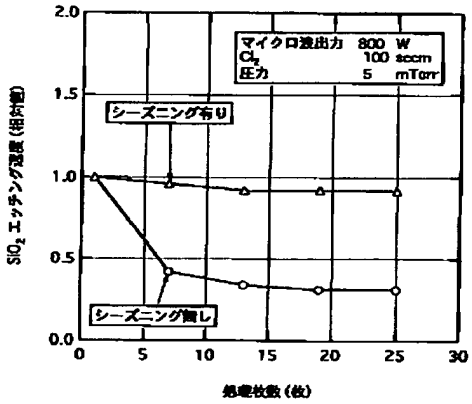
【図4】

図4



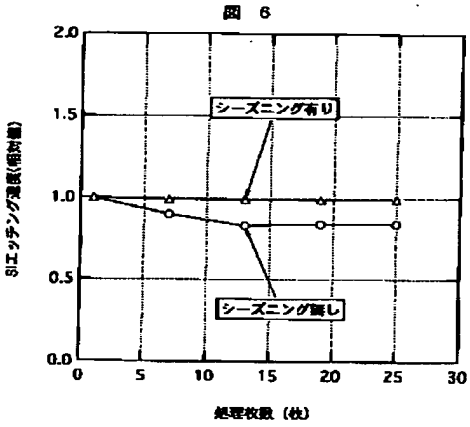
【図5】

図 5



【図6】

図 6



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CLAIMS

[Claim(s)]
[Claim 1] Clean by the gas plasma containing a fluorine and the mixed gas of the independent gas of the chlorine gas after cleaning (Cl2) or chlorine gas (Cl2), and oxygen gas (O2) is used as etching gas. In the plasma etching system which performs etching of silicon, polycrystal silicon, and a silicide with 20 or less mTorr of gas pressure The plasma-etching technique characterized by starting etching after discharging by accustoming with the plasma of the mixed gas of Cl2 gas and SiCl4 gas after cleaning (seasoning is called below).
[Claim 2] The plasma-etching technique that the gas containing a fluorine according to claim 1 is characterized by being the independent gas or mixed gas of 2 3 fluoride [6 fluoride / sulfur / (SF6) and nitrogen] (NF3) and xenon fluoride (XeF2), a fluorine (F2), and 3 fluoride-salt ** (ClF3).
[Claim 3] The plasma-etching technique characterized by performing this cleaning and this seasoning continuously in this cleaning according to claim 1 and this seasoning using the substrate or the quartz substrate in which the oxide film (SiO2) was formed on silicon.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention cleans by the gas plasma containing a fluorine. After cleaning, In the plasma etching system which performs etching of silicon, polycrystal silicon, and a silicide, using the mixed gas of the independent gas of chlorine gas (Cl2) or chlorine gas (Cl2), and oxygen gas (O2) as etching gas It is related with the suitable plasma-etching technique to suppress change of the etch rate of the oxide film (SiO2) which is the silicon and the substratum layer after cleaning, and raise the homogeneity between wafers.
[0002]
[Description of the Prior Art] Conventionally, in the plasma process including etching, in order to clean in order to prevent grain contamination of a wafer, and to lose the residue of the processing room after cleaning, post cleaning is performed. In SF6 and NF3 gas, when cleaning is used, N2, Ar, and O2 gas plasma are used for post cleaning. In addition, reference:Hiratsuka ****, washing design P 41-53, and 1992.Summer are mentioned to the thing about this kind of technique.
[0003]
[Problem(s) to be Solved by the Invention] In the conventional etching system, it was not taken into consideration about the influence affect the etching property of the residue of the processing interior of a room after cleaning, but the etch rate of the oxide film of silicon and a substratum layer decreased with cleaning after-treatment number of sheets, and there was a trouble of changing **** of a substratum oxide film.
[0004] It is in the purpose of this invention offering the plasma-etching technique by which a decrement of the silicon after cleaning and the etch rate of an oxide film is suppressed, change of **** of a substratum oxide film is prevented, and the homogeneity between good wafers is acquired.
[0005]
[Means for Solving the Problem] The above-mentioned purpose performs seasoning with the plasma of the mixed gas of after cleaning] Cl2 gas and SiCl4 gas, and can attain it by decreasing the influence of the residue of the processing interior of a room of cleaning.
[0006]
[Function] Drawing 1 shows change by the processing number of sheets of the emission spectrum of SiF at the time of etching silicon with Cl2 gas plasma, after cleaning with SF6 gas plasma. The intensity of the emission spectrum of SiF generated by the reaction of silicon and a fluorine decreases with processing number of sheets, and becomes almost fixed. The processing interior of a room found that the fluorine remained after cleaning by the gas which contains a fluorine from this. Next, change of the etch rate of the emission spectrum of SiF at the time of adding SF6 gas in Cl2 gas, silicon, and an oxide film is shown in the drawing 2 and the drawing 3 . As shown in drawing 2, the intensity of the emission spectrum of SiF increases with the increase in the addition of SF6. Moreover, as shown in drawing 3, the etch rate of silicon and an oxide film increases with the increase in the addition of SF6. It found out that the etch rate of silicon and an oxide film fell with a decrement of a remains fluorine from this. Therefore, seasoning is performed with the mixed-gas plasma of Cl2 and SiCl4 for elimination of the remains fluorine after cleaning, and when time change of the intensity of the emission spectrum of SiF becomes below a constant value, change of the etch rate of silicon and an oxide film can be suppressed by ending seasoning and starting etching.
[0007]
[Example] Hereafter, drawing 4 explains one example of this invention. Drawing 4 shows the schematic diagram of a microwave plasma etching system. In drawing 4, the microwave oscillated from the magnetron 1 spreads a waveguide 2, and is led to the processing room 4 through a bell jar 3. The processing room 4 is constituted by the bell jar 3, the installation electrode 5, and the grounding electrode 6. The cleaning gas (SF6), the seasoning gas (Cl2, SiCl4), and etching gas (chlorine gas (Cl2)) which are supplied by the magnetic field formed of the direct current supplied to a solenoid coil 8 from DC power supply for magnetic-field occurrence 7 and the microwave electric field from the etching gas supply system 9 are plasma-ized. Cleaning of the processing room 4 is performed by SF6 gas plasma. Seasoning of the processing room 4 is performed by the mixed-gas plasma of Cl2 and SiCl4. At the time of cleaning and seasoning, the substrate made from a quartz is laid on the installation electrode 5. It is etched after cleaning and seasoning in the substrate 10 currently laid in the installation electrode 5 by Cl2 gas plasma. Cleaning, seasoning, and the pressure at the time of etching are controlled by the evacuation equipment 11. The energy of the ion which carries out incidence to a substrate 10 is controlled by RF power supplied to the installation electrode 5 from RF generator 12.

The difference in change of the etch rate of the silicon by the existence of seasoning and an oxide film is shown in the drawing 5 and the drawing 6. The mixed-gas plasma of Cl2 and SiCl4 performed seasoning, and seasoning was suspended when the photogenesis intensity ratio of the spectrum which acted as the monitor of the emission spectrum of SiF every 10 seconds, and was measured to time tn and time tn-1 was set to 1**0.002. By performing seasoning after cleaning, the influence of remains of the fluorine generated at the time of cleaning is suppressed, and change of an etch rate can be prevented.

[0008] According to this example, the influence of the remains fluorine after cleaning can be suppressed, and the etch rate of silicon and an oxide film can be prevented.

[0009] In this example, although the effect was explained about the microwave plasma etching system, the same effect is acquired also in other electric discharge methods, for example, an inductive-coupling type electric discharge method, and an internal energy supply electric discharge method.

[0010]

[Effect of the Invention] According to this invention, the influence of the remains fluorine after cleaning can be suppressed, and the etch rate of silicon and an oxide film can be prevented.

[Translation done.]

* NOTICES *

Field

[Field of the Invention] this invention cleans by the gas plasma containing a fluorine. After cleaning, In the plasma etching system which performs etching of silicon, polycrystal silicon, and a silicide, using the mixed gas of the independent gas of chlorine gas (Cl2) or chlorine gas (Cl2), and oxygen gas (O2) as etching gas It is related with the suitable plasma-etching technique to suppress change of the etch rate of the oxide film (SiO2) which is the silicon and the substratum layer after cleaning, and raise the homogeneity between wafers.

[Translation done.]

* NOTICES *

Technique

[Description of the Prior Art] Conventionally, in the plasma process including etching, in order to clean in order to prevent grain contamination of a wafer, and to lose the residue of the processing room after cleaning, post cleaning is performed. In SF6 and NF3 gas, when cleaning is used, N2, Ar, and O2 gas plasma are used for post cleaning. In addition, reference:Hiratsuka ****, washing design P 41-53, and 1992.Summer are mentioned to the thing about this kind of technique.

[Translation done.]

* NOTICES *

Effect

[Effect of the Invention] According to this invention, the influence of the remains fluorine after cleaning can be suppressed, and the etch rate of silicon and an oxide film can be prevented.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the conventional etching system, it was not taken into consideration about the influence affect the etching property of the residue of the processing interior of a room after cleaning, but the etch rate of the oxide film of silicon and a substratum layer decreased with cleaning after-treatment number of sheets, and there was a trouble of changing **** of a substratum oxide film.
[0004] It is in the purpose of this invention offering the plasma-etching technique by which a decrement of the silicon after cleaning and the etch rate of an oxide film is suppressed, change of **** of a substratum oxide film is prevented, and the homogeneity between good wafers is acquired.

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem] The above-mentioned purpose performs seasoning with the plasma of the mixed gas of after cleaning] Cl2 gas and SiCl4 gas, and can attain it by decreasing the influence of the residue of the processing interior of a room of cleaning.

[Translation done.]

* NOTICES *

OPERATION

[Function] Drawing 1 shows change by the processing number of sheets of the emission spectrum of SiF at the time of etching silicon with Cl2 gas plasma, after cleaning with SF6 gas plasma. The intensity of the emission spectrum of SiF generated by the reaction of silicon and a fluorine decreases with processing number of sheets, and becomes almost fixed. The processing interior of a room found that the fluorine remained after cleaning by the gas which contains a fluorine from this. Next, change of the etch rate of the emission spectrum of SiF at the time of adding SF6 gas in Cl2 gas, silicon, and an oxide film is shown in the drawing 2 and the drawing 3 . As shown in drawing 2, the intensity of the emission spectrum of SiF increases with the increase in the addition of SF6. Moreover, as shown in drawing 3, the etch rate of silicon and an oxide film increases with the increase in the addition of SF6. It found out that the etch rate of silicon and an oxide film fell with a decrement of a remains fluorine from this. Therefore, seasoning is performed with the mixed-gas plasma of Cl2 and SiCl4 for elimination of the remains fluorine after cleaning, and when time change of the intensity of the emission spectrum of SiF becomes below a constant value, change of the etch rate of silicon and an oxide film can be suppressed by ending seasoning and starting etching.

[Translation done.]

* NOTICES *

EXAMPLE

[Example] Hereafter, drawing 4 explains one example of this invention. Drawing 4 shows the schematic diagram of a microwave plasma etching system. In drawing 4, the microwave oscillated from the magnetron 1 spreads a waveguide 2, and is led to the processing room 4 through a bell jar 3. The processing room 4 is constituted by the bell jar 3, the installation electrode 5, and the grounding electrode 6. The cleaning gas (SF6), the seasoning gas (Cl2, SiCl4), and etching gas (chlorine gas (Cl2)) which are supplied by the magnetic field formed of the direct current supplied to a solenoid coil 8 from DC power supply for magnetic-field occurrence 7 and the microwave electric field from the etching gas supply system 9 are plasma-ized. Cleaning of the processing room 4 is performed by SF6 gas plasma. Seasoning of the processing room 4 is performed by the mixed-gas plasma of Cl2 and SiCl4. At the time of cleaning and seasoning, the substrate made from a quartz is laid on the installation electrode 5. It is etched after cleaning and seasoning in the substrate 10 currently laid in the installation electrode 5 by Cl2 gas plasma. Cleaning, seasoning, and the pressure at the time of etching are controlled by the evacuation equipment 11. The energy of the ion which carries out incidence to a substrate 10 is controlled by RF power supplied to the installation electrode 5 from RF generator 12. The difference in change of the etch rate of the silicon by the existence of seasoning and an oxide film is shown in the drawing 5 and the drawing 6. The mixed-gas plasma of Cl2 and SiCl4 performed seasoning, and seasoning was suspended when the photogenesis intensity ratio of the spectrum which acted as the monitor of the emission spectrum of SiF every 10 seconds, and was measured to time tn and time tn-1 was set to 1**0.002. By performing seasoning after cleaning, the influence of remains of the fluorine generated at the time of cleaning is suppressed, and change of an etch rate can be prevented.
[0008] According to this example, the influence of the remains fluorine after cleaning can be suppressed, and the etch rate of silicon and an oxide film can be prevented.
[0009] In this example, although the effect was explained about the microwave plasma etching system, the same effect is acquired also in other electric discharge methods, for example, an inductive-coupling type electric discharge method, and an internal energy supply electric discharge method.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is explanatory drawing showing the processing number-of-sheets dependency of SiF photogenesis intensity.
[Drawing 2] It is explanatory drawing showing SF6 addition dependency of SiF photogenesis intensity.
[Drawing 3] It is explanatory drawing showing SF6 addition dependency of Si and SiO2 etch rate.
[Drawing 4] It is the block diagram of the microwave plasma etching system which shows one example of this invention.
[Drawing 5] It is explanatory drawing showing the processing number-of-sheets dependency of SiO2 etch rate for explaining the effect in one example of this invention.
[Drawing 6] It is explanatory drawing showing the processing number-of-sheets dependency of Si etch rate for explaining the effect in one example of this invention.
[Description of Notations]
3 [-- A solenoid coil, 9 / -- Substrate.] -- A bell jar, 6 -- A grounding electrode, 7

[Translation done.]